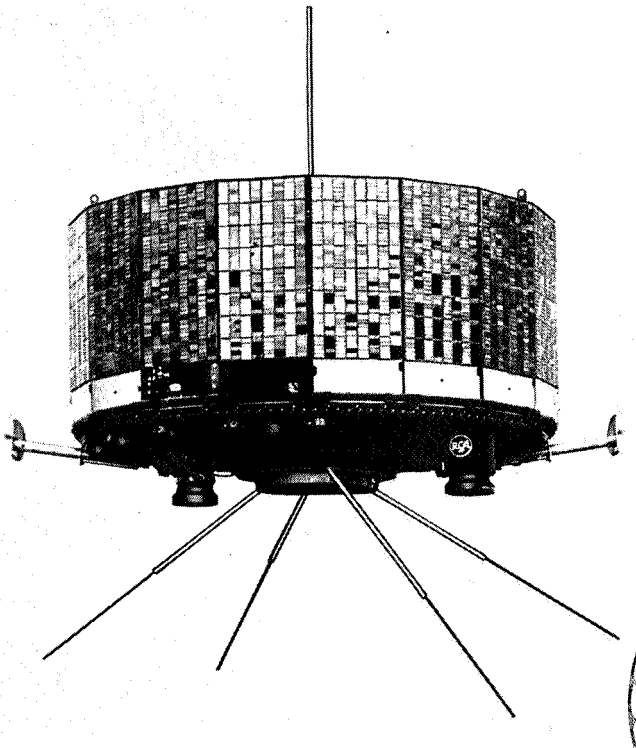
808

# DELTA 12
# FLIGHT FLASH REPORT
# T + 8 HOURS







prepared by

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September 18, 1962

# PROJECT DELTA 12

# TIROS F

# *FLIGHT FLASH REPORT

Approved by:

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*NOTE: Due to the short period of time allowed for the publication of this report and not having downrange and all local data available for review, some information may be incomplete or in error. The comprehensive Field Flight Report which will be published in about 21 days will include a detailed analysis of all data.

GODDARD SPACE FLIGHT CENTER
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ATLANTIC MISSILE RANGE

# DELTA 12 FLIGHT FLASH REPORT

## 1.0 SUMMARY

1.1 DELTA 12 (TIROS F), Vehicles 318/2024/20001, Range Test No. 5046, was launched September 18, 1962 at 0353:08.916 EST. First and second stage performance was nominal. Third stage performance was nominal as indicated by preliminary orbital predictions. The spacecraft was injected into orbit and is reported to be operating satisfactorily.

1.2 The weather forecast for the launch period was generally good. No significant wind shears were predicted. A high layer of clouds at 35,000 feet covered approximately 3/10 of the sky. A middle layer between 10,000 and 12,000 feet and a lower layer between 2,000 and8,000 covered approximately 1/10 . Visibility was 12 miles. The surface wind direction was 200° at 6 knots.

## 2.0 LAUNCH PREPARATIONS

### 2.1 F-6 Day Operations

The F-6 Day operations were conducted on September 10, 1962. No irregularities were encountered during this operation.

### 2.2 F-3 Day Operations

The F-3 Day All Systems Test was originally scheduled for 13 September 1962. Radiographs of interface connectors P-58, P-59, and P-60 taken on 12 September revealed a possible shorted condition of two conductors on J-58 and bad solder joints together with cut wire strands on J-59 and J-60. It was decided to run the F-3 Day Test as scheduled and inspect and repair the interface connectors later. The test was conducted satisfactorily with range scheduling. After completion of the F-3 Day Test, the connectors were opened and inspected. "Bird caging" of wires, cut strands and poor solder joints necessitated rework of connector J-60 and replacement of connectors J-58 and J-59. The spacecraft and third stage had to be removed, and the second stage lifted approximately12 inches for removal of the connectors. A cut in the insulation of one conductor in the J-58 wire bundle was found during rework. The conductor was shortened and resoldered. After the connectors were reworked, the second stage was lowered and mated to the first stage. The third stage and spacecraft were erected and a new F-3 Day Test was scheduled. This was successfully completed on 14 September 1962. A second set of radiographs taken on 14 September were reviewed showing the connectors to be mated satisfactorily.

## 2.3 F-1 Day Operations

The F-1 Day Operations started at 0800 EST on September 17, 1962. All tests were satisfactorily completed.

## 2.4 F-0 Day Operations

The F-0 Day Tests began at 1915 EST, at T-480 minutes, on September 17, 1962. All tests were normal and the terminal count started at 0308 EST. The terminal count proceeded until T-14 seconds when a hold was called because of a Blockhouse recorder problem. The count was recycled to T-8 minutes after a 2 minute and 18 second hold. The count was resumed and proceeded without incident to lift-off at 0353:08.916 EST.

# 3.0 TRAJECTORY

The range plotting charts indicated that the vehicle flew slightly right of nominal from lift-off to 110 seconds. From 110 seconds until MECO, the plotting charts indicated nominal. The second stage impact trace was approximately one sigma right of nominal for the entire flight. The booster and second stage impact points were 200 and 170 nautical miles further downrange than expected, indicating higher than nominal performance. In the pitch plane, the vehicle was slightly above normal for the entire flight.

# 4.0 SEQUENCE OF EVENTS

The following event times are listed in seconds after lift-off up to the stage III spinup and separation events. It should be noted that SECO and the switch to coast control are functions of BTL guidance commanded SECO.

| Event | Expected (in seconds) | Actual |
|---|---|---|
| Lift-off | 0 | *(0353:09.0 EST) |
| Start Roll Program | +2 | +2 |
| Stop Roll Program | +9 | +9 |
| Start First Pitch Rate | +10 | +10 |
| Enable BTL | +80 | +80 |
| BTL Steering | +90 | +90 |
| MECO | +160.4 | +160.6 |
| Stage II Ignition | +164.4 | +164.6 |
| Start Yaw Program | +166.4 | +166.6 |
| Stop Yaw Program | +174.4 | +174.6 |
| Jettison Nose Fairing | +176.4 | +176.6 |

| Event | Expected (in seconds) | Actual |
|---|---|---|
| Start Pitch Program | +H78.4 | +H78.6 |
| SECO | +273.4 | +273.8 |
| Switch to Coast Control | +275.9 | +275.3 |
| Start Coast Pitch Program | +289.4 | +289.6 |
| Stop Coast Pitch Program | +299.4 | +299.6 |
| Start Coast Yaw Program | +304.4 | +304.6 |
| Fire Spin Rockets | +636.4 | +636.6 |
| Fire Retros | +638.4 | +638.6 |
| Stage III Ignition | +651.9 | +652.9 |
| Stage III Burnout | +693.9 | +693.5 |

*Lift-off time is taken from first stage programmer start signal.

## 5.0 PROPULSION

### 5.1 First Stage

First stage performance was near nominal producing an average total sea level thrust of 150,000 pounds for a burning time of 160.6 seconds. Propellant utilization is reported as being undiscernible from 100%. A more detailed analysis of the telemetry records will be made for the final report.

All propulsion parameters were smooth in transition and during steady state operation.

Normal vernier solo operation was noted and was 13 seconds in duration. Stage II/I separation effects appeared normal.

### 5.2 Second Stage

Second stage performance was approximately 7% below nominal producing an average thrust of 7,060 pounds. SECO was commanded by BTL after 109.2 seconds of burning time.

The by-pass helium pressurizing system performed well with an average cycling rate of approximately once every 30 seconds. Maximum "q" effects were noted and caused some of the vibration characteristics normally observed during this region.

Helium heat generator ignition occurred on time and system performance was excellent throughout flight.

Oxidizer probe operation was observed to occur shortly after SECO when the oxidizer probes became uncovered caused by boil-off of the acid in the thrust chamber cooling jacket.

## 6.0 GUIDANCE AND CONTROLS

### 6.1 First Stage

The first stage flight control system performed satisfactorily. Lift-off transients in all three control axes were small and easily damped. First stage pitch and roll programs occurred as scheduled and were of normal magnitude. Maximum "q" effects were negligible. First stage hydraulic pressure was normal. First stage inverter voltage was 1.5 volts lower than the nominal 115 VAC. The second stage roll gyro error at stage II ignition was approximately 0.5°, indicating an especially low first stage roll gyro drift rate. There were no abnormal vehicle disturbances encountered either at MECO or second stage separation.

### 6.2 Second Stage Powered Flight

Attitude errors in pitch and yaw at first stage separation were small and easily damped.

The yaw attitude gyro error signal exceeded its telemetry limits at the initiation of the second stage yaw program at MECO plus 6-seconds. This was expected because of the lagging response of the vehicle to a high yaw rate program. The error was quickly damped at the termination of the yaw program. Response of pitch attitude control to the pitch program at this time was also satisfactory indicating no recurrence of the low amplitude stability problem encountered in recent Delta flights. The fairing was jettisoned on time and caused only minor attitude disturbances. All program functions were received on time and were of proper magnitude. Hydraulic pressure was normal and steady. The guidance inverter was steady at 115.5 VAC. The static inverter voltage was good at 14.7 VAC. The expected CW roll moment was seen during second stage powered flight. SECO was commanded by BTL at 0857:42.8 Zulu.

### 6.3 Coast Flight Control

Coast control was initiated at 1.5 seconds after SECO and performed satisfactorily. At no time did the gyro attitude errors exceed their preset dead zones. Programmed functions during coast flight were received on time. Coast attitude errors at Stage II/III separation were approximately 1/4° up and to the right with associated rates less than 0.3°/sec.

Spin rate as recorded by both vehicle and spacecraft telemetry was 100 rpm. This is approximately 20 percent less than the expected 126 rpm. The cause of this anomaly is unknown but under investigation.

### 6.4 Ground Guidance

BTL operated satisfactorily and steering commands during both first and second stage powered flight were of relatively low order and vehicle response to them was normal. Open loop steering just prior to SECO was approximately 1/4° pitch down and 1.3° yaw left. Vehicle response to these commands was also normal.

## 7.0 DATA AND INSTRUMENTATION

### 7.1 Optics

All cameras committed to Test 5046 were successfully operated.. Analysis will have to await processing. There were 9 metric, 14 engineering sequential, and 20 Range User Documentary cameras committed.

### 7.2 Radars

The following radars tracked the vehicle.

| | | | |
|---|---|---|---|
| 1.16 | FPS-16 | AMR | T+0 - T+520<br>T+550 - T+765 |
| 0.16 | FPS-16 (XN-1) | PAFB | T+20 - T+480<br>T+560 - T+765 |
| 3.16 | FPS-16 (XN-2) | G.B.I. | T+74 - T+715 |
| 2.16 | FPS-16 | Bermuda | T+320 - T+700<br>T+840 - T+960 |
| 1.1 | Mod IV | AMR | T+0 - T+120 |
| 1.2 | Mod IV | AMR | T+0 - T+129 |
| 1.4 | Mod 2 | AMR | T+20 - T+217 |

No radar or beacon problems were evident. Coverage is considered adequate for all trajectory requirements.

The 7090 computer used the 0.16 radar for IIP information and quick look orbit predictions.

### 7.3 Telemetry

7.3.1 Transmitters - The performance of both transmitters was very good. Signal level was high, center frequency, deviation, pulse length and repetition rates were all good. There was no vibration susceptibility, and no channels were lost.

7.3.2 Ground Stations - The Hangar AE and Cape Tel 2 stations acquired usable data for more than 100 seconds after spinup, and spinup was reported by both sites. DAC had excellent data through and well after spinup. Dropouts during Stage I flame and ionization times were very minor. All "real time" functions were observed as they occurred.

Down range coverage was provided by Wallops Island; New Boston, New Hampshire; and St. Johns, Newfoundland. Preliminary reports indicate good signal acquisition at Wallops Island, and signal from T+188 through T+202 at New Boston. St. Johns also reports good acquisition, but no times were reported.

7.3.3 ELSSE - ELSSE coverage was good, fromT+4 to T+561 with one momentary dropout at T+134 seconds.

7.4 Command Destruct

No problems were evident on either the command transmitter or receiver. No commands were necessary or sent.

7.5 Vehicle Instrumentation

At this time there are no apparent instrumentation malfunctions except for PDM #2, Channel 7, which was overvoltage.

## 8.0 SPACECRAFT

8.1 Mating of the Tiros F spacecraft to the third stage attach fitting revealed several problem areas. A portion of the bolt shield had to be removed in order for the spacecraft to mate to the attach fitting. Since this portion of the shield is used to retain the Marmon clamp with the third stage, 2 lanyards were added for this purpose. An interference fit existed when the two surfaces (spacecraft to attach fitting) were mated. Approximately 0.012 inches of material was scraped from the spacecraft side of the interface to effect a fit. The spacecraft was scraped rather than the attach fitting since it was the softer of the two materials. Also, to assure no damage to spacecraft antennas, 4 brackets were installed to direct the Marmon clamp downward during ejection of the spacecraft.

Launch countdown commenced at 0715 EST on 17 September 1962. Spacecraft checkout and final flight preparations were conducted without incident and generally ahead of schedule. At the completion of spacecraft checks, severe weather moved into the Cape Canaveral area. Because of safety regulations, it was necessary to clear the gantry of all personnel. This precaution was in effect for approximately 45 minutes. At 0900 EST, operations were again allowed to commence on the pad.

Ordnance installation, fairing installation, and payload checks were completed without incident. During this period, it was noted that some interference did exist on the spacecraft command frequency. This interference caused no problem to the spacecraft or delays to the countdown.

Terminal count commenced on schedule at 0308 EST, 18 September 1962. The spacecraft beacons were turned on prior to terminal count and remained on. At T-14 seconds a short hold was required to investigate a first stage engine blockhouse recorder problem. The count was recycled to T-8 minutes to repair the recorder.

TIROS F, now named Alpha Psi One, was successfully launched and placed into orbit. Winkfield, England Minitrack first acquired the spacecraft and third stage and tracked both. Neither third stage/spacecraft separation nor despin were observed over Winkfield. The command and data acquisition station Nicola, on San Nicholas Island, PMR, California first tracked the satellite on its first orbit and verified despin. The command and data acquisition station at Wallops Station, Virginia was the first station to interrogate TIROS F. All telemetry data indicated that the spacecraft was functioning normally.

The Nicola Station interrogated TIROS F on orbits two and three and the first TV pictures were read out from the spacecraft. The pictures have been termed excellent and all systems have been found to be functioning in a most normal manner.

The spin rate of the spacecraft after despin was measured 7.1 RPM. This is less than required and an early spinup command will probably be required. The low spin rate after despin correlates well with the low spin rate of 100 RPM after third stage spinup indicating proper operation of the spacecraft yo-yo system. Detailed study is required for determining the cause of the approximately 20% below nominal spinup rate.

## 9.0 SATELLITE TRACKING STATION

The FPB Satellite Tracking Station monitored the two spacecraft beacons during the countdown and through powered flight. The spacecraft was tracked for a period of approximately 719 seconds after liftoff, which was sufficient to observe all of the powered flight including third stage spin-up, ignition and burnout. Preliminary analysis of the tracking data indicates that third stage ignition occurred within 1 second of the expected time and the total burning time was approximately 40.6 seconds.

Doppler data were transmitted to the automatic plotting board at the mission control center, Hangar AE, via telephone line, and to the GSFC Space Control Center via data phone and voice link.

After MECO the doppler plot fell below the pre-plotted nominal and therefore the total doppler shift was low compared with the expected shift by about 95 cps.

It is suspected that this was due either to a drift in the 136.23 mc beacon which was being tracked or to an erroneous pre-plotted nominal range rate graph . At the present there is no evidence to support either premise except that orbital velocity was, in fact, achieved. Further study is required to resolve this discrepancy.

On first pass, signals from the spacecraft, now classified as 1962 Alpha Psi were received at the expected time.

Early calculations of orbital parameters by BTL and the AMR 7090 computer were as follows: The preliminary SPACON orbit is included for comparison.

| | BTL | 7090 | SPACON |
|---|---|---|---|
| Apogee | 372.1 nm | 432 nm | 384.1 nm |
| Perigee | 368.3 nm | 291 nm | 369.2 nm |
| Period | 98.49 min. | 98 min. | 98.73 min |
| Inclination | 58.22° | 58.13° | 58.3° |

The BTL and 7090 calculations were based on radar tracking data at SECO and an assumed nominal coast and third stage flight. The differences in the BTL and 7090 calculations reflect the differences in BTL and FPS-16 radar tracking data and the inclusion of the open loop steering commands. Detailed study is required to explain these differences.

## 10.0 PAD DAMAGE

10.1 Only normal pad damage was incurred.